TABLE 1 Associations Between BAC (Presence vs. Absence and Severe vs. Absent) and Incident Cardiovascular Disease and Diabetes

	BAC Presence		BAC Severity Severe	
	HR (95% CI)	p Value	HR (95% CI)	p Value
Composite CVD endpoint				
Model 1	1.16 (0.92-1.48)	0.215	2.25 (1.29-3.94)	0.005
Model 2	1.44 (1.04-1.99)	0.030	3.54 (1.89-6.64)	<0.001
Model 3	1.39 (1.00-1.93)	0.048	3.37 (1.80-6.31)	<0.001
Coronary heart disease				
Model 1	1.22 (0.94-1.58)	0.130	2.40 (1.34-4.29)	0.003
Model 2	1.46 (1.04-2.05)	0.028	3.50 (1.82-6.72)	<0.001
Model 3	1.44 (1.02-2.01)	0.036	3.40 (1.76-6.57)	<0.001
Stroke				
Model 1	1.19 (0.83-1.72)	0.338	2.29 (1.13-4.63)	0.022
Model 2	1.47 (0.98-2.19)	0.059	3.21 (1.51-6.83)	0.003
Model 3	1.39 (0.92-2.08)	0.116	2.85 (1.32-6.15)	0.008
Peripheral artery disease				
Model 1	0.97 (0.61-1.55)	0.912	1.59 (0.62-4.07)	0.335
Model 2	1.43 (0.80-2.58)	0.231	3.24 (1.16-9.00)	0.025
Model 3	1.37 (0.74-2.52)	0.313	2.93 (1.05-8.16)	0.040
Incident diabetes				
Model 1	0.75 (0.51-1.08)	0.125	1.27 (0.58-2.78)	0.555
Model 2*	0.88 (0.58-1.33)	0.542	1.24 (0.48-3.17)	0.658

BAC = breast arterial calcification; CI = confidence interval; CVD = cardiovascular disease; HR = hazard ratio; Model 1 = age-adjusted; Model 2 = multivariable adjusted for age, smoking, high-density lipoprotein (HDL)/total cholesterol ratio, hypertension, physical activity, body mass index, alcohol intake, type 2 diabetes, cardiovascular disease history, parity number, menopausal status; Model 2* = multivariable adjusted for age, body mass index, physical activity, HDL/total cholesterol ratio and smoking; Model 3 = model 2 plus pulse pressure.

develop medial calcification in other vascular beds, this needs further investigation. One study in renal patients showed that BAC was associated with medial calcification in other arterial beds (4). It is hypothesized that medial calcification leads to CVD through increased arterial stiffness (5). This is supported by our data, because we found that adding pulse pressure attenuated the associations. A limited number of studies conducted in specific patient groups reported increased cardiovascular risks associated with medial calcification in other vascular beds, comparable to those we found for severe BAC (5).

The presence of BAC is modestly associated with CVD, with an approximately 3-fold increased risk for severe BAC, independent of traditional risk factors. This indicates a possible contribution of a medial, nonatherosclerotic pathway to CVD.

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Under-Recognition of Aortic and Aortic Valve Disease and the Risk for Sudden Death in Competitive Athletes

Sudden deaths (SDs) in young athletes are unexpected, tragic, and highly visible events. Considerable attention has been focused on pre-participation screening to prevent these events (1). Aortic stenosis (AS) is known as an important cause of SD in the young, whereas aortic dissection/rupture is a catastrophic condition not usually associated with demise early in life (2,3). The role of these diseases in athletic field deaths and their identification by standard routine pre-participation screening (e.g., history and physical examination in the United States) is incompletely understood.

The U.S. National Registry of Sudden Death in Athletes, a forensic and clinical database that collects SDs of competitive athletes under 40 years of age (4),

was accessed for deaths due to aortic disease (AD) and AS. Data collection techniques and sources have been outlined previously (4), largely on the basis of public domain information, including the LexisNexis database. Data on pre-participation screening and cause of death were obtained through autopsy reports, media accounts, and correspondence with decedents' families and high schools/colleges. Data are presented as mean ± SD.

Of the 2,588 deaths in the registry, 44 (1.7%) were due to AS (n = 19) or AD (n = 25). AD (suspected Marfan syndrome in 12 athletes, including 2 with a fibrillin mutation) was due to rupture in 23 (15 with identified dissection) and aortic coarctation in 2 athletes. Surgical repair was attempted in 1 athlete. Of those with AS, 12 had bicuspid valves, including 4 with dilated ascending aorta. Athletes were 17.6 ± 5.1 years of age (age range: 11 to 36 years); 40 were male and 4 female. With regard to race, 29 (65%) athletes were white, 10 (23%) were black, and 5 (11%) were Hispanic.

The most frequent sports were football and basketball (n = 13 each) and baseball/softball (n = 7). Two athletes with aortic dissections were lifting weights at the time of collapse. AS deaths occurred during or just after exercise in 18 of 19 athletes; AD deaths occurred during exercise (n = 16), while sedentary (n = 6), or during sleep (n = 2). Therefore, 34 of 44 athlete deaths were associated with exertion during practice or competition.

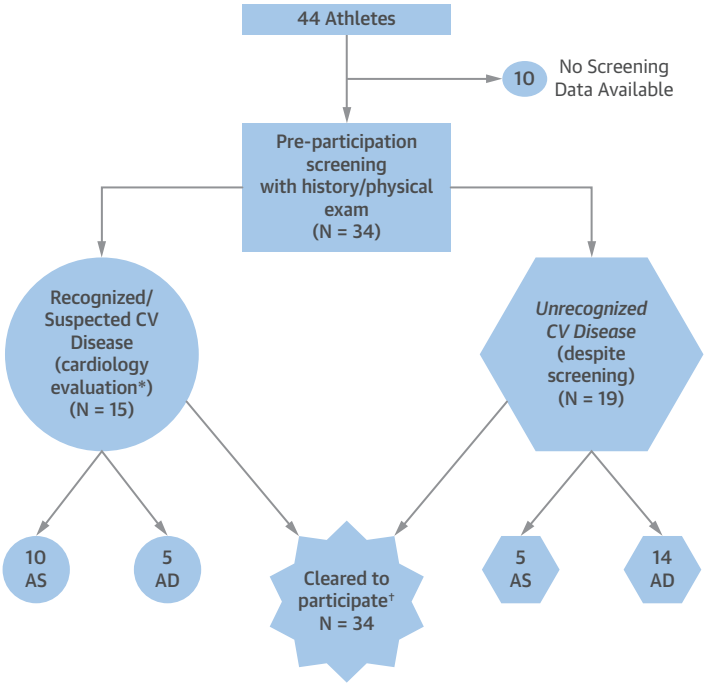
Pre-participation history and physical examination screening data were available in 34 athletes (**Figure 1**). A total of 19 athletes (56%; 5 AS, 14 AD) were cleared for competition without suspicion of cardiovascular disease. In the other 15 athletes (44%; 10 AS, 5 AD), cardiovascular disease was identified or suspected with specialized cardiac testing, but each of these athletes returned to competition. Notably, 8 athletes (AS 2, AD 6) were evaluated for chest/back/abdominal pain shortly before collapse, and 3 were discharged from the emergency room <24 h before death.

These data in athletes who died suddenly underscore the importance of AS and AD as potentially identifiable causes of death. These data are particularly pertinent to the ongoing discussion in cardiology regarding pre-participation screening and criteria for disqualification versus eligibility (1). Of note, in these athletes, pre-participation screening frequently failed to detect AS or AD. However, it is possible that the American Heart Association 14-item history and physical examination recommendations would have raised suspicion of heart disease by virtue of a systolic murmur (for AS) or body habitus (for AD) in many (1). We cannot predict what the effect of 12-lead electrocardiographic screening would have been on the detection of AS and AD (1). Because there is no mandatory reporting of sudden athlete deaths, it is possible our registry under-reported some of these events.

Despite raising the suspicion or recognition of cardiovascular disease through screening, 15 other athletes were not disqualified from sports and continued to compete, including 11 who eventually died during physical exertion while training or in competition. These recommendations for continued eligibility in competitive sports were largely inconsistent with Bethesda Conference 36 guidelines (2,5).

Although potentially identifiable by history/physical examination, which is the standard screening model in the United States, there was no suspicion of AD or AS during screening in the majority of athletes. Of the remaining athletes who were identified as having cardiovascular disease, standard consensus criteria were not employed to reduce risk or prevent SD by disqualification from sports.

FIGURE 1 Results of Pre-Participation Screening in 34 Competitive Athletes Who Died of AD or AS



*Includes 4 athletes with 12-lead electrocardiograms. †Includes 3 athletes in whom some modified restrictions to competitive sports participation were recommended. AD = aortic disease; AS = aortic stenosis; CV = cardiovascular disease.

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High-Risk Plaque Detected on Coronary CT Angiography Predicts Acute Coronary Syndrome

The study by Puchner et al. (1) revealed that the presence of high-risk plaque features on coronary computed tomography angiography (CTA) in patients presenting to the emergency department with acute chest pain, but negative initial electrocardiogram and troponin, increases the likelihood of acute coronary syndrome (ACS). This is independent of the presence of significant coronary artery disease and clinical risk assessment (age, sex, number of cardiovascular risk factors).

First, patients in this study were recruited between April 2010 and January 2012, and hence, at least 2-year medium-term clinical follow-up would be available, but the primary endpoint of this study was ACS during index hospitalization. ACS was defined as acute myocardial infarction (MI) or unstable angina pectoris that was pre-defined and adjudicated by an independent clinical events committee. This study included 472 patients, and only 37 patients had ACS. It is not clearly stated in the body of the paper how many patients had acute MI, or how many went on to have invasive coronary angiography and revascularization. It would have been clearer if the authors elaborated on this in the body of the paper. It is of further interest for the authors to report whether high-risk features on CTA predict these harder clinical endpoints. A recent study by Nasis et al. (2) reported the long-term outcome (median follow-up of 47.4 months) of 585 consecutive patients who underwent CTA assessment in the emergency department, and the event rate for coronary revascularization was 6.2% (n = 34). It is therefore of interest that Puchner and colleagues report whether high-risk or "vulnerable plaque" features in this study predicted longer-term ACS, coronary revascularization, and mortality as well.

Second, the assessment of plaque burden, which has been the strongest independent predictor of long-term ACS (3), was not reported in this study. It would have been of significant interest to compare high-risk plaque features with plaque burden for prediction of short-term and long-term ACS in this study.

Third, the authors defined low attenuation plaque as <30 HU on the basis of previously published criteria described by Motoyama et al. (4), who used a tube voltage of 135 kV. The scanner parameters were not described by Puchner et al. (1). Could Puchner and colleagues (1) speculate about the applicability of the low attenuation plaque definition used in their study if the tube voltage differed from that in the study by Motoyama et al. (4)?

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